PRELIMINARY
SECTION 404(b)(1) EVALUATION

2003 EXPERIMENT
TENNESSEE RIVER MILES 194.0-195.0
HARDIN COUNTY, TENNESSEE
JULY 2003

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I. Project Description

The 2003 experiment would be based on the 2002 experiment conducted on September 17, 2002. A Section 404(b)(1) Evaluation was completed for the 2002 experiment titled: Section 404(b)(1) Evaluation, Experimental Mussel Relocation, Tennessee River Miles 194.0-195.0, Hardin County, Tennessee, July 2002. This evaluation was an appendix to the 2002 environmental assessment titled: Environmental Assessment, Experimental Mussel Relocation, Tennessee River Mile 194.0-195.0, Hardin County, Tennessee, September 2002. The Finding of No Significant Impact (FONSI), including Statement of Findings, and Findings of 404 (b)(1) Guidelines Compliance for the 2002 experiment was signed on September 7, 2002. All these documents have been referenced in this evaluation.

The 2003 experiment would be smaller in physical scope than the 2002 experiment. The 2003 experiment (¼ acre) would affect less than half of the river bottom surface area than the 2002 experiment (over ½ surface acre). Only one-tenth of the river substrate volume (100 cubic yards) would be disturbed as compared to the volume disturbed (1,000 cubic yards) during the 2002 experiment. Test dredge scoops would be assessed in greater detail during this 2003 experiment. All else being equal, it would be expected that approvals, permits, and concurrence for the 2003 experiment, would be the same as those provided for the 2002 experiment.

A. Location

The 2003 experiment would be conducted just upstream of the city of Crump in Hardin County, Tennessee (Figure 1.). The proposed experimental site (Figure 2.) would be located between approximate Tennessee River Miles 194.0 (Latitude 35^{O}, 12', 23", North; Longitude 88^{O}, 18', 42", West) and Tennessee River Mile 195.0, (Latitude 35^{O}, 11', 32", North; Longitude 88^{O}, 18', 33", West) on the left descending bank, in Kentucky Reservoir. The proposed test footprints would be located within the proposed experimental site in the vicinity of Latitude 35^{O}, 11', 44", North; Longitude 88^{O}, 18', 39", West, approximately 12 miles downstream of Pickwick Lock and Dam. The proposed experimental site can be located on a U.S. Geological Survey 7.5 Minute Series Quadrangle map labeled 13 NE – Pittsburg Landing.

B. General Description

The 2003 experiment consists of removing approximately 100 cubic yards of gravel and sand from a selected dredge site within the proposed experimental site. A clamshell dredge and split-hulled dump scow would be used to perform the experiment. The clamshell dredged would remove the top 1-foot (Treatment 1) and 3-feet (Treatment 2)

layer of substrate. These bucket scoops would be placed on a flat barge. These scoops would be processed by washing the material through a series of stacked graded screens with mesh sizes of 3", 1 ½", ½", and ¼". Live mussels would be removed. All mussels would be counted, identified, measured by group size, and handed over to the Tennessee Wildlife Resources Agency once data collection has been completed. The dredge bucket scoop impact would be evaluated. The material would be placed into a dump scow one layer deep and transported for placement in open-water over a selected disposal site. The split hull would be carefully opened to disperse the substrate in a thin layer (about ½ foot deep) over the river bottom. The two treatments would be compared to diver removal efficiency. Non-listed mussels are the targeted test organisms in this experiment. This 2003 would follow redesigned protocols.

C. Authority and Purpose

The Rivers and Harbors Act of July 3, 1930, ch. 847, 46 Stat. 927 (1930) authorized the permanent improvement of the Tennessee River to a navigable depth of nine feet at low water from the mouth to Knoxville, Tennessee. The Tennessee Valley Authority Act of 1933 (16 U.S.C.§ § 831-831ee) authorized TVA to provide a nine-foot channel in the Tennessee River from Knoxville to its mouth. Since passage of the Tennessee Valley Authority Act of 1933 the Corps of Engineers, in cooperation with TVA, has maintained navigation channels on TVA projects by performing necessary maintenance dredging operations. This division of responsibility is outlined in a Memorandum of Agreement between the Corps and TVA dated October 26, 1962. TVA is a cooperating agency in this 2003 experiment.

The purpose of the 2003 experiment is to determine if this experimental mussel relocation method is a viable technique to safely remove mussel communities prior to unavoidable maintenance dredging activities. A safe, efficient, timely, and holistic mussel relocation method would be needed because mussel communities are occasionally found at maintenance dredging sites. Maintenance dredging would be required to maintain a safe and open authorized navigation channel.

Open-channel maintenance necessitates periodic dredging in areas of frequent natural river substrate deposition. A final Environmental Impact Statement (EIS) covering the Nashville District's open-channel maintenance program for the Tennessee River and tributaries was filed with the President's Council on Environmental Quality on March 7, 1976.

D. General Description of Dredged Material

1. General Characteristics of Material

The material at the proposed dredge site consists of loose gravel and sand.

2. Quantity of material

Approximately 100 cubic yards of material would be excavated from a total area of approximately ¼ surface acre.

3. Source of Material

The dredge material would be the result of natural river deposition.

E. Description Of Proposed Discharge Site

1. Location

A site location map is attached (Figure 1). The proposed discharge site would be located approximately 100 meters offshore along the left descending bank in Hardin County, Tennessee. The discharge site nests within a segment of the river (Tennessee River Miles 194.0-195.0) currently permitted for commercial sand and gravel extraction. Some commercial dredging activities have occurred there within the last few years.

2. Size

Approximately ¼ surface acre at the proposed discharge site would be covered with material spread in a thin layer of approximately ½ foot deep.

3. Type of Site

The discharge site would be located in open-water.

4. Types of Habitat

The results of the 2002 experiment revealed that the substrate contained cobble, gravel, sand, and some fines. The substrate at the discharge site provides mussel habitat as evidenced by a small community of mussels living at the site.

5. Timing and Duration of Discharge

The proposed activities would be performed over the course of approximately 3-5 days. The work would be scheduled to avoid the fish and mussel spawning season (March-August) and when the water temperature would be greater than 60 ^{O} F. At this temperature, mussels are mobile enough to extract themselves if they are buried under a thin layer of sediment. September and October are generally the driest months of the year. This time frame would minimize sediment runoff due to heavy rains.

F. Description Of Disposal Method

A hydraulically operated split-hull scow would be used to disperse the dredge material over the discharge site in open water. The hull of the scow would be carefully opened to allow the contents to spread out on the river bottom in a thin layer. This action minimizes smothering of organisms, and changes to the substrate contours and elevation.

II. Factual Determinations

This evaluation concerns discharge of dredged sediment below ordinary high water.

A. Physical Substrate Determinations

1. Substrate Elevations and Slope

The substrate elevation ranges between 324 and 334 feet in mean see level. The river bottom appears to be furrowed and uneven with a slight slope riverward. Water depth varies from 20-30 feet. Dredge material would be spread across the river bottom at

approximately ½ foot deep. This placement method would result in little change to the current substrate elevation and slope.

2. Sediment Type
The sediment consists of cobble, gravel and sand. This material would be equivalent to the material at the discharge site.

3. Dredged/Fill Material Movement
The dredged material consists of gravel and sand. Due to the large particle size of the dredge material, and considering the depth of placement, movement of the material as a result of wave or wind action or from water level fluctuation after placement would not be not expected. The substrate at the discharge site consists of small particles indicating that water velocity would be slow enough for small particles to accumulate. Dredged material would spread across the river bottom at approximately ½ foot deep. This shallow layer would minimize slumpage or movement of the material.

4. Physical Effects on Benthos
Very small mussels and aquatic insects that are buried by disposal of a ½ foot layer of dredged material may not survive. Large juveniles and adult mussels would be expected to be able to dig their way out to the surface since these larger individuals have been known to migrate through substrate up to a foot deep. The dredge material would be loose and unconsolidated, making it easier for mussels to migrate through the material. The impact would be unavoidable but highly localized and small. It has been anticipated that dredged material would be expected to stay in place and provide stable habitat. A benthic community would be expected to form since the dredged material already contains a small commercial mussel community. Natural drift from upstream would add to the community.

5. Other Effects (address in EA under Navigation and Safety)
Noise, vibration, and wake would result from dump scow and towboat activities within the proposed experimental site. These activities could locally infringe on commercial and recreational traffic, fisherman, and citizens living adjacent the river. Fish and other nekton would be disturbed and would temporarily move from the area. These effects are unavoidable but would be of short duration and limited area.

6. Actions Taken to Minimize Impacts
All efforts would be made to avoid fish and mussel spawning activities that usually occur between March and August. Work would be planned in early fall during low flow conditions to minimize water quality impacts resulting from turbidity. The 2003 experiment would also be observed by biologists from other agencies (Tennessee Wildlife Resources Agency, U.S. Fish and Wildlife Service, U.S. Geological Survey, Tennessee Valley Authority).

Prior to any mechanical activity, divers would survey the dredge and discharge sites. Mussels would be collected during timed searches and quadrat sampling. Mussels not

used in the experiment would be given to the Tennessee Wildlife Resources Agency for further care. This procedure would reduce impact to the mussel community as a whole. It also reduces mixing of large individuals from the resident and relocated populations.

Small juvenile mussels missed during these searches would either remain at the dredge site or be transported to the discharge site. To minimize mussel burial impact, dredged material would be dispersed slowly to allow for deposition of no more than ½ foot of substrate. The experiment would be conducted when water temperature would be expected to reach 60^{O} F. At this temperature, and with minimal burial by dredged material, mussels left in the disposal area would likely be able to dig their way up to the surface of the substrate.

B. Water Circulation, Fluctuation, And Salinity Determinations

1. Water

Kentucky Reservoir maintains a regulated flow to ensure adequate navigation depths. Monitoring on Pickwick Reservoir indicates that water quality is considered good. Overall, the "health" of the aquatic resources in Kentucky Reservoir has been considered good within the vicinity of the proposed experimental site. Kentucky Reservoir is riverine at this location and is generally well mixed lacking thermal or dissolved oxygen stratification in this segment of the river

a. Salinity

Not applicable. The proposed action would occur in a freshwater system.

b. Water Chemistry

Parameters of physical and chemical quality (Temperature, Specific Conductance, Dissolved Oxygen, hardness, and pH) would not be affected by the work. The dredge material consists of uncontaminated inert cobble, gravel, sand and fines.

c. Clarity

Due to the relatively large particle size of the dredged material, any decrease in water clarity would be minor, localized, and would cease quickly due to rapid settling of the substrate.

d. Color

The dredged material would not affect the true color of the water. The material would be composed of inert and insoluble material. Localized effects on apparent color would be seen; however, these affects would be temporary and localized given the large particle size of the material.

e. Odor

The proposed activities would not have any effect on odor. The substrate contains very little organic matter.

f. Taste

The proposed action should not have any effect on taste. The dredged material consists of insoluble material.

g. Dissolved Gas Levels
The proposed activities would not affect the composition or nature of dissolved gases in the water column. No biological or chemical oxidation demand would be expected to occur since the dredge substrate consists of inert material.

h. Nutrients
The proposed activities would have no effect on nutrient concentrations. The dredged material consists of inert material.

i. Eutrophication
The proposed action would have no effect on eutrophication. This process does not occur in a fast flowing river.

j. Others as Appropriate
Specific conductance, hardness, and water temperature would not be affected by the work.

2. Current Patterns and Circulation
The proposed activities would not affect existing current and circulation patterns. The amount of material proposed for disposal would be negligible. Spreading the dredge material in a thin layer would prevent any obstruction to circulation.

a. Current Patterns and Flow
The proposed action would not change existing current patterns or flow in the river. The water depth and low profile of the dredge material would not affect current patterns.

b. Velocity
Water velocity would not be affected by the proposed experiment. The flow of the Tennessee River is large and regulated.

c. Stratification
Not applicable. The proposed activity would be located in a segment of the Tennessee River that would be riverine in character precluding stratification.

d. Hydrologic Regime
The proposed activities would not affect the normal fluctuations in the hydrologic regime of the Tennessee River.

3. Normal Water Level Fluctuations
The proposed action would not affect the normal water level fluctuations in the Tennessee River. Water level has been affected by pool operations and releases by both Pickwick and Kentucky Locks and Dams.

4. Salinity Gradients
Not applicable. The proposed action would occur in a freshwater system.

5. Actions That Will Be Taken to Minimize Impacts
Based on visual inspections, all efforts would be made to ensure compliance with State water quality rules and permits. The work would occur during daylight hours and during the dry months of September and October during low flow conditions to minimize potential water quality impacts.

C. Suspended Particulates/Turbidity Determinations

The proposed amount of dredge material would be very small. Elevated levels of suspended particles would be extremely localized. The dredge material consists of gravel and sand. Given the large particle size, the material would be expected to settle out of the water column quickly. On completion of the activities, local turbidity would be expected to return to background levels.

1. Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site
Any effect on suspended particles or turbidity would be localized and short-termed. Re-suspended material from dump scow disposal would be expected to settle rapidly given the large particle size and small volume of material. In perspective, disposal induced turbidity and suspended solids are an insignificant fraction of levels that occur during ordinary high flows following storm events.

2. Effects on Chemical and Physical Properties of the Water Column
The excavated material would be composed of natural gravel and sand found in the river system. Due to particle size contaminants do not adhere to these materials. Excavation should have little or no effect on the chemical or physical properties or the water column. The material would be inert.

a. Light Penetration
The temporary increases in suspended sediment load and turbidity would reduce light penetration through the water column. But this affect would be short term and highly localized. The affect would be limited to the duration of the dredging and discharge. Once these activities cease, light penetration would return to normal.

b. Dissolved Oxygen
There would be no affect on dissolved oxygen. The dredge material would be virtually inert and would have no affect on biological or chemical oxygen demand.

c. Toxic Metals and Organics
The TVA ecological health rating in 2000 noted that Kentucky Reservoir sediment was free of pesticides and PCBs. Concentrations of metals were within background

levels. Additionally, due to the type and particle size of the material, contaminants would not be expected to adhere to the particles.

d. Pathogens
No pathogens would be expected to be released into the water column. The dredge material consists of large particles. Pathogens would not readily adhere to large inert particles.

e. Aesthetics
Turbidity and suspended solids within the vicinity of the dredge and discharge sites would affect the aesthetics of the water column. These affects would be local and temporary. On completion of the work, the aesthetics of the water column would be the same as pre-work conditions.

f. Others as Appropriate
The aesthetics of the river view would be temporarily affected at the dredge and discharge sites by the visual appearance of necessary maintenance dredging vessels and equipment. This effect would only last as long as it takes to complete the work.

3. Effects on Biota
No effects related to chemical-biological interaction would be anticipated. Primary affects on the biota would be physical. Biota would be dislodged, relocated, or covered, however this affect would be limited and confined to dredge and disposal footprints within the proposed experimental site.

a. Primary Production, Photosynthesis
There could be temporary but localized decreases in primary production and photosynthesis during maintenance dredging and disposal activities because of slight increases in suspended solids and turbidity. This effect would be short term and minor. In perspective, any disruption to primary production within the experimental site would be insignificant with respect to the Tennessee River system where primary production would continue to occur.

b. Suspension/Filter Feeders
There could be some mortality of suspension or filter feeders during maintenance dredging activities. These organisms could be impacted by the localized increases in suspended solids and turbidity. Any adverse impacts should be temporary and very localized.

c. Sight Feeders
Because sight feeders can avoid the immediate area, any adverse impacts should be minor. Impacts would be temporary. Sight feeders would be expected to return when the proposed action was completed.

4. Actions Taken to Minimize Impacts

A detailed protocol has been developed to implement the 2003 experiment. An inter-agency group (noted in section II. A. 6.) redesigned protocols to minimize environmental impact and to collect scientific data to assess dredging impacts on affected mussel communities. The amount of area disturbed would be limited and localized in comparison to comparable mussel habitat within the rest of the Tennessee River system.

D. Contaminant Determinations

Data collected by TVA in 2000 indicated that Kentucky Reservoir sediments were free of pesticides and PCBs. Metal concentrations were within background levels. Due to the type and particle size of the material, contaminants would not be expected to adhere to the dredged material.

E. Aquatic Ecosystem And Organism Determinations

1. Effects on Plankton

Minimal effects would be possible as a result of brief re-suspension of a fraction of the sediments during dredging and placement. Plankton may be temporarily disturbed during maintenance dredging activities, however the effects would be temporary, localized, and minor. Plankton are considered ubiquitous and would be expected to drift back into the area on completion of the activities.

2. Effects on Benthos

Some benthic organisms would be lost at both the dredge and discharge sites. The dredge material consists of a sediment size expected to support benthic habitat. A benthic community would likely colonize both the dredged and discharge areas within a short period of time. Suspended particulate/turbidity impacts on benthic macroinvertebrates downstream of the site would be localized, short-lived, and of shallow depth given the affects of laminar flow, and disposal method.

3. Effects on Nekton

The proposed action would have no sizeable affect. Nekton are mobile and would avoid the sites during activities, but would return on completion of the work.

4. Effects on Aquatic Food Web

Effects on the aquatic food web would be negligible because of the localized and short-term nature of the impacts. During the dredging and placement activities, benthic organisms would be either damaged or exposed. They would initially provide additional food for fish and birds. After the activities, the aquatic community would be expected to return to current conditions.

5. Effects on Special Aquatic Sites

a. Sanctuaries and Refuges

The proposed activities would not be expected to affect sanctuaries or refuges. The closest mussel sanctuary would be located approximately 7 miles upstream.

b. Wetlands
No wetlands as defined in 33 CFR 323.2 (c) would be affected by this proposed work. All proposed work would be in open water.

c. Mud Flats
There would be no affect. There are no mud flats.

d. Vegetated Shallows
There would be no affect. The activities would be confined to open water where there are no vegetated shallows.

e. Coral Reefs
No coral reefs exist. The Tennessee River is a freshwater system.

f. Riffle and Pool Complexes
The Tennessee River is a large deep water system. These features would not be found in this system.

6. Threatened and Endangered Species
These proposed actions have been coordinated through consultation with the U.S. Fish and Wildlife Service and the Tennessee Wildlife Resources Agency. During the 2002 experiment, four Pink muckets (*Lampsilis abrupta*) and one Fanshell (*Cyprogenia stegaria*) were collected. The individuals were unharmed and handed over to the Tennessee Wildlife Resources Agency for further care. Takings were not exceeded and remained within the parameters outlined in the 2002 Biological Opinion dated September 9, 2002. The surface area and volume of material affected by the 2003 experiment has been significantly reduced, therefore encounters with listed species would be expected to be significantly reduced. It would be anticipated that the Biological Opinion issued by the USFWS for the 2003 experiment, would be comparable to the 2002 Biological Opinion, and therefore, no significant change would be expected. The 2002 Biological Opinion concluded that the 2002 experiment was not likely to jeopardize the continued existence of federally listed species nor destroy or adversely modify any critical habitat. Consultation would continue for this 2003 experiment.

7. Other Wildlife
There would be no noticeable effect on other wildlife. Terrestrial animals would be potentially disturbed by the noise and activities. However disturbance would be localized and temporary. Amphibians and reptiles would be mobile enough to avoid the area during the activities. Pre-work conditions would be expected to return when activities were complete.

8. Actions Taken to Minimize Impacts
A detailed protocol has been developed to implement the 2003 experiment. An inter-agency group (noted in section II. A. 6.) redesigned protocols to minimize

environmental impact and to collect scientific data to assess dredging impacts on affected mussel communities. The amount of area disturbed would be limited and localized in comparison to comparable mussel habitat within the rest of the Tennessee River system.

F. Proposed Disposal Site Determination

All dredge material would be disposed in open water at a pre-selected discharge site.

1. Mixing Zone Determinations.

Mixing zones comprise a limited area or volume of water where a discharge plume would be progressively diluted by the receiving water. The discharge plume consists of predominantly cobble, gravel, sand, and some fines. Suspended sediment and turbidity during the dredging and disposal operations would be highly localized and short-lived. The effects of these activities have been seen to dissipate within 300 feet downstream of the site. Sampling of similar operations demonstrates that disposal induced turbidity and suspended solids are a small fraction of levels that occur during ordinary high flows following storm events.

2. Determination of Compliance with Applicable Water Quality Standards.

Water Quality Certification in the form of an Aquatic Resource Alteration Permit (ARAP) was issued for the 2002 experiment. Certification is in process and would be expected for the 2003 experiment given the smaller scope of the 2003 experiment.

3. Potential Effects on Human Use Characteristics.

There would be no significant negative effect on recreation, navigation, fishing, or any other human use characteristics. The 2003 experiment would be very localized and temporary.

a. Municipal and Private Water Supply.

No water supply intake would be affected by the dredge or discharge activities. The nearest water intake would be 2 miles downstream the experimental area.

b. Recreational and Commercial Fisheries.

The proposed work would have minor adverse impacts on fishing opportunities during implementation. Anglers would avoid the proposed experimental site due to increased activities. Disturbance of the substrate would dislodge benthic organisms that could attract fish feeding in the area. The spawning season would be avoided by performing the work in late summer. Any other impact to the fisheries would be insignificant since fish are mobile enough to avoid the location.

Commercial mussel harvests could be slightly affected. It would be hoped that commercial musselers would not collect test mussels that have been marked for recapture for monitoring purposes. Limiting access to the proposed experimental site for mussel harvesting would be insignificant in view of the large beds of commercial mussels found upstream and downstream the experimental area. If

successful, the long-term effect of the experimental mussel relocation could provide a means to cultivate mussel beds elsewhere within the Tennessee River system.

c. Water Related Recreation.
The increased noise, equipment, and personnel working in the area would temporarily disturb recreation. However, river traffic would continue to move freely within the navigation channel, but at a recommended slower speed for safety.

d. Aesthetics.
Suspended solids and turbidity effects would be short-term and localized. Dredge and placement induced turbidity would be an insignificant fraction of that which occurs during ordinary high flows following storm events.

e. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, and Similar Preserves.
The proposed actions are not expected to affect any of these areas. The closest historical landmark would be Shiloh National Park. It would be located approximately 3 miles upstream the proposed experimental site.

G. Determination Of Cumulative Effects On The Aquatic Ecosystem
The proposed work immediately affects an area of about ¼ surface acre. Given the size of the Tennessee River, the affects would be limited, of short duration, and negligible in size. If the proposed experimental mussel relocation were successful, it would be possible to consider this action as a method to remove large numbers of freshwater mussels prior to unavoidable maintenance dredging. Approximately 6 percent of the Tennessee River has been affected by maintenance work during the 50-year existence of the existing navigation channel. Not all sites were found to contained significant mussel populations. Dredged material was disposed in the back chutes of islands. In many cases, disposing this material over the mud bottom expanded benthic habitat as evidenced by significant mussel beds that currently inhabit the old disposal sites.

The proposed experiment would be designed to maximize safe mussel removal and to minimize death, injury, or stress associated with handling, transport time, and potential burial at a pre-selected placement site. It would be anticipated that by moving communities and a portion of their current habitat to appropriate placement sites, the community would establish itself at the new location. This cumulative effect would potentially increase mussel numbers and expand their associated habitat.

H. Determination Of Secondary Effects On The Aquatic Ecosystem
Secondary effects on the aquatic ecosystem could be potentially beneficial if the long-term effect of the proposed experimental mussel relocation method sustains, or increases the mussel resources. Preserving and potentially expanding mussel communities and their habitat would also benefit listed species since they often reside in the mussel community.

III. Findings Of Compliance Or Non-Compliance With The Restrictions on Discharge

A. Adaptation of The Section 404(B)(1) Guidelines to this Evaluation
No adaptations of the Section 404(b)(1) guidelines were made relative to this evaluation.

B. Evaluation of Availability Of Practicable Alternatives To The Proposed Discharge Site, Which Would Have Less Adverse Impact On The Aquatic Ecosystem
There would be no feasible alternative to working in the river. The proposed experimental mussel relocation method would be designed to relocate significant mussel resources prior to planned and unavoidable maintenance dredging. A No Action would not have a less adverse impact on the aquatic system. As shoaling continues to lessen the width and depth of the navigation channel, barges eventually drag along the bottom, crushing the aquatic community. In the event of barge grounding, emergency measures to free barges could be more devastating to the aquatic community because emergency activities tend to be immediate and not as accurate or protective of the aquatic system as planned maintenance dredging operations.

C. Compliance With Applicable State Water Quality Standards
Water quality standards set by the State of Tennessee and any special conditions delineated in the state water quality certification or Aquatic Resource Alteration Permit (ARAP) would be followed.

D. Compliance With Toxic Effluent Standard Or Prohibition Under Section 307 Of The Clean Water Act
The dredging operations would not violate Section 307 of the Clean Water Act.

E. Compliance With The Endangered Species Act Of 1973
Coordination and consultation procedures with the U.S. Fish and Wildlife Service have been followed.

F. Compliance With Specified Protection Measures For Marine Sanctuaries Designated By The Marine Protection, Research, And Sanctuaries Act Of 1972
Not applicable. The proposed activities are located outside of these areas.

G. Evaluation of Extent of Degradation of the Waters of the United States

1. Significant Adverse Effects on Human Health and Welfare

The proposed actions would not result in any significant adverse impacts on human health and welfare.

a. Municipal and Private Water Supply

No municipal and private water supplies would be affected by the proposed activities. The nearest water intake would be located 2 miles downstream.

b. Recreational and Commercial Fisheries

The discharge of dredged material would not have any long-term adverse affect on the fishery resources. Impacts would be limited to the brief re-suspension of sediment and localized increases in turbidity resulting from placement activities. Mussel harvesting could be affected for up to one year. The experimental procedure would use a mark-and-recapture method to locate individual mussels for monitoring purposes. It would be best if no mussels were removed from the action areas prior to one year. The footprint of the proposed activities would span approximately 0.2-0.3 river miles within the proposed experimental site. This area would be small compared to the remaining miles of the Tennessee River open to commercial mussel harvesting, recreational and commercial fisheries.

c. Plankton

The proposed action would have little effect. Plankton are considered ubiquitous and would drift into the action area unhindered when the work has been completed.

d. Fish

The proposed activities would not result in any significant adverse impacts on recreational or commercial fishing. Fish would avoid the area temporarily while the proposed activities were occurring, but they would be expected to return on completion of the 2003 experiment.

e. Shellfish

The experimental mussel relocation method would be proposed as a possible procedure to safely remove mussels out of the authorized navigation channel requiring maintenance dredging. If successful, this method could be used to protect large mussel communities by relocating as many numbers and size classes as possible to selected disposal areas. Cultivating new beds would expand the commercial resource. Additionally, any listed species, especially juveniles that are missed during traditional hand removal and relocation by divers, would have a chance to grow within the relocated community. Doing the experiment as planned would kill, injure or dislodge some of the invertebrates at the experimental dredge site. However the long-term benefits would be expected to outweigh the short-term, immediate, and highly localized impact resulting from the experimental method. It would be expected that mussels and other shellfish with time, would re-colonize the dredge area.

f. Wildlife
The maintenance activities would temporarily affect terrestrial wildlife due to increased noise and human activity associated with the project. However the proposed action would not have any significant long-term affects.

g. Special aquatic sites
The proposed work would not occur within any special aquatic sites.

2. Significant Adverse Impacts on Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystems
The proposed action would have no significant adverse impacts on life stages of aquatic life and other wildlife dependent on aquatic ecosystems.

3. Significant Adverse Impacts on Aquatic Ecosystem Diversity, Productivity, and Stability
The proposed action would have no significant adverse impacts on aquatic ecosystem diversity, productivity, or stability.

4. Significant Adverse Impacts on Recreational, Aesthetic, and Economic Values
The proposed action would have no significant adverse impacts on recreational, aesthetic, or economic values. The footprints of the test dredge and disposal sites cover 0.2-0.3 miles of river. Any hindrance to extract commercial sand and gravel, harvest commercial mussels would be minimal considering there are several other places within the Tennessee River that these activities can and do occur.

H. Appropriate And Practicable Steps Taken To Minimize Potential Adverse Impacts Of The Discharge On The Aquatic Ecosystem
The proposed experiment would occur when the water temperature would be above 60^{O} F. Also, the dredged material would be disposed in a layer of approximately ½ foot deep on the river bottom. Impacts of the discharge on the aquatic ecosystem would be minimized because with warm water temperatures, mussels would be expected to be mobile enough to migrate through the thin layer of dredged material. This action would minimize burial of the organisms.

I. On The Basis Of The Guidelines, The Proposed Disposal Site For The Discharge Of Dredged Or Fill Material Is
Specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem.